CMMI RESPONSE TO FY 2019 REPORT FOR
NSF CMMI COMMITTEE OF VISITORS (COV)

Date of COV: June 26-27, 2019

Program/Cluster/Section:

Division: Division of Civil, Mechanical, and Manufacturing Innovation (CMMI)

Directorate: Directorate for Engineering (ENG)

Number of actions reviewed: 320

Awards: 154

Declinations: 154

Returned without Review (RWR): 12

Total number of actions within Program/Cluster/Division during the period under review:

Awards: 2386

Declinations: 12,371

Returned without Review (RWR): 841

Manner in which reviewed actions were selected: Stratified Random Sampling

22-23 Jackets per member.

Jackets are randomly selected to include the desired distribution of awards, declinations, and returned proposals within each cluster and special initiatives across the 4 fiscal years under review. Additional jackets are selected to provide geographic or demographic balance as needed. COV members may request additional jackets for review, as needed.

COV Membership

	Name	Affiliation
COV Chair/ Co-Chair:	**Chair:** Dr. Delcie Durham	University of South Florida
	Co-Chair: Dr. Yan Jin	University of Southern California
COV Members:	Dr. Lesley Berhan	University of Toledo
	Dr. Tabbetha Dobbins	Rowan University
	Dr. Neil Duffie	University of Wisconsin-Madison
	Dr. Sara Wadia-Fascetti	Northeastern University
	Dr. Carol Friedland	Louisiana State University
	Dr. Scott Grasman	Kettering University
	Dr. Robert Ivester	Department of Energy
	Dr. Byun-Lip Lee	Air Force Office of Sponsored Research
	Dr. Majid Manzari	George Washington University
	Dr. Daniel McAdams	Texas A&M University
	Dr. David Meaney	University of Pennsylvania
	Dr. Grace Peng	National Institutes of Health
	Dr. Lawrence Seiford	University of Michigan
	Dr. Gregory Washington[1]	University of California – Irvine

[1] Member of the Directorate for Engineering Advisory Committee

COV RECOMMENDATIONS and CMMI RESPONSES

Note: COV recommendations have been copied from the full COV report and grouped by common themes with references to the sections in the full report.

Quality, integrity and effectiveness of the NSF merit review process

Finding: The overall quality and integrity of the review processes were excellent, with new mechanisms employed to help maintain the effective productivity of the division. In general, the documentation supporting the decisions made by the Program Officers (POs) was complete, with clear justification for the award decisions. A few outliers were noted and addressed in the following sections of the report.

Recommendation: The division staff is encouraged to continue training, oversight, and streamlining activities promoting the high standards of the division. (Executive Summary)

CMMI Response 2019: *CMMI maintains high standards through regular training and process improvements. In FY19, we have developed a training manual to capture divisional practices (CMMI PO Manual is available on our internal CMMI SharePoint site), intended to help with onboarding new POs as well as a refresher and reference for all POs.*

Recommendations: COV members recommended that the formatting of reviews with strengths and weaknesses for both criteria be strongly encouraged. (Section I.2)

The COV again recommends that reviewers be instructed to provide justification for each of the strengths and weaknesses. (Section I.3)

The COV recommends that NSF provide more guidance/requirements to panel members, e.g., a template for the review, or require the articulation of at least one strength and one weakness for IM, BI, and the summary. (Section III.1)

COV members recognized that this [challenge interpreting Broader Impacts] is an ongoing issue across NSF, and as one measure to address the disparity between IM and BI, recommended that the formatting of reviews with strengths and weaknesses for both criteria be strongly encouraged, if not required. (Section III.1)

The COV recommends that the Program Officers pay attention to encouraging reviewers to make needed review comments by providing adequate review guidance. (Section II.1)

The COV recommends that any Additional Solicitation Specific Review Criteria be included in reviewer and panel templates to facilitate specifically addressing these requirements. (Section I.1)

CMMI Response 2019: *Program Officers use a variety of techniques to ensure that the documented feedback from reviewers/panelists is useful including emailing instructions, providing templates, training, and paying careful attention during the panel. We agree that the use of a customized template would help solicit content for strengths and weaknesses for all review criteria. Many CMMI POs develop and distribute custom panel summary templates for solicitations to help reviewers*

capture content for all review criteria. We will suggest all POs consider doing so for the panels they manage. The new CMMI PO Manual reinforces this practice. Despite these efforts, the quality of reviews varies with each individual reviewer. We will continue to take advantage of NSF-wide efforts to train and enable our POs to communicate the value of reviews to the reviewers. and help maximize the quality of the reviews for the PIs.

Recommendations: The COV recommends CMMI consider four reviewers as the standard and increase the number when the scale of funding is larger, possibly using the mail-in reviewer program. CMMI should also consider innovative mechanisms to help solicit reviewers such as increasing the prestige of serving as a panel reviewer, assigning a title, stipend/honorarium in addition to per diem, the publication of "thanks to the following reviewers," etc. (Section III.1)

CMMI Response 2019: *CMMI follows NSF policy that 3 reviews are the required minimum and relies on PO discretion to request and utilize more reviews as needed. The division welcomes the COV's suggestions for recruiting reviewers and is actively exploring innovative ways to do that as well as ensure reviewers are properly trained to evaluate proposals for high risk and high impact. While the point on increasing the prestige of review service is well taken, CMMI must balance that aspect against the requirement for reviewer anonymity which is an important feature of the NSF process.*

Recommendation: The COV found that some panel summaries included "Suggestions for Improvement" and supports the implementation of this section in the special solicitation reviews. (Section I.4)

CMMI Response 2019: *We will suggest POs add this heading to their Panel Summary templates for special solicitations such as LEAP-HI and CAREER.*

Recommendation: Occasionally the decision statement [in an RA] was cursory, and in a few cases reviewed, the rationale was not adequately addressed. The COV found the use of the RA template wording was useful but are concerned when specific details regarding a decision are not included. Occasionally the decision statement was cursory, and the rationale not adequately addressed or inconsistent. The COV recommends providing sufficient detail regarding the rationale to justify each PO funding decision. (Section I.5)

A small number of the reviewed proposals within the different clusters raised "red flags" in terms of the overall process being followed that resulted in a well-documented decision. Examples of these red flags include funding proposals that were not discussed in panels and triaged as "do not consider," poorly justified individual panelist reviews accompanied by poorly written panel summaries and only template Review Analysis text. (Section III.1)

There was a case where the panel recommended funding and the award was not made without justifiable explanation within the review analysis. The COV recommends that CMMI Program Officers provide justifications for this kind of irregular case to the Reviewers and PIs. (Section III.1)

CMMI Response 2019: *During this time period that the COV reviewed, CMMI POs had some of the highest workloads at the agency in terms of proposal count. In consideration of this, management agreed to allow the use of the RA template language (without any customized content) for those proposals that were not considered competitive. Now PO workload is more reasonable and, starting in FY19, all RAs include customized content addressing the rationale for the PO recommendation.*

Recommendation: The COV recommends that final award decisions for large solicitations (e.g. LEAP-HI), be made (or reviewed) by at least two other program officers. This will reduce any bias or apparent bias of the Program Officer. (Section I.5)

CMMI Response 2019: *We are committed to minimizing bias in the review process. LEAP-HI proposal reviews and award recommendations are in fact managed by a team of two POs. However, NSF systems are set up to indicate only one cognizant PO for each proposal, so this team-based practice may not have been apparent to the COV. Also, POs make all of their funding recommendations in collaboration with the other POs in their program (for the larger programs) or their administrative clusters, before discussing their recommendations with the Division Director and Deputy Division Director.*

Recommendation: The COV has noted that CMMI conducts an analysis regarding the diversity of reviewers annually and recommends CMMI utilize those reviewer analytics to make continuous improvement in panel diversity. The COV also recommends that CMMI maintain a larger number and a more expansive set of reviewers that includes a wider diversity in various dimensions including gender, ethnicity, domain expertise, institution, academic/industry, and stakeholder. (Section II.1)

CMMI Response 2019: *CMMI is committed to diversity in our panel membership. Program Officers use a variety of tools to identify and invite a diverse pool of reviewers. While the diversity of individual panels may vary, at the divisional level, CMMI traditionally seats panels with a representative distribution of the key diversity criteria noted above and as evidenced by data provided to the COV. We will continue to provide tools and training to our POs to encourage diversity among panelists.*

Recommendations: For each participant to have a clear idea about his/her role will help each one to be more effective in playing the role. The COV recommends that CMMI provide reviewers/panelists with clear information about the participants' roles in final funding decision-making. (Section II.1).

CMMI Response 2019: *During the panel, POs make it clear that panel input is very important for the recommendation process but that panelists do not actually recommend proposals for funding. Panelists provide their advice as to the competitiveness of a proposal. To help reinforce that point, CMMI panelists are asked to bin proposals during panel into one of three groups; Primary Consideration, Secondary Consideration and Do Not Consider. They are not asked to recommend a proposal for funding. Program Officers can then recommend a proposal for funding, management can concur with the recommendation, but final funding decisions are actually made by our Division*

of Grants and Agreements. POs consider the outcomes from all panels in their program, program portfolio balance, diversity, and budget as they come together with their team to formulate funding recommendations. We recognize that this may not have been made as clear as it could have been to the COV. We commit to providing more clear information on this topic to future COVs.

Recommendation: The COV also recommends that CMMI provide information on the roles and responsibilities of the various types of personnel staffed in the division; details on the number of division personnel and workload balance; and details on workload per Program Officer. During this COV review, the CMMI staff indicated such detailed information which was helpful for the COV review process. The COV recommends CMMI provide this information for future COV meetings. The variety of personnel involved in each jacket could explain some of the errors involved in the review, award management process. (Section III.1)

CMMI Response 2019: *This is a great suggestion. CMMI continuously strives to maintain appropriate staffing levels and workload balance. CMMI will assess what information we can provide to future COVs to provide additional context.*

Recommendation: The COV recommends that the Program Officers document how any COI is managed prior to, during, and following the review. There was a single case where a panelist who is very familiar with the proposal topic provided the most negative and comprehensive review. This panelist had a similar proposal declined in the COV review jackets. Such a scenario could be considered as COI in terms of competing for scarce resources. The COV recommends CMMI review the COI policy to avoid such cases from happening again. (Section II.2)

CMMI Response 2019: *CMMI takes very seriously our commitment to the integrity and ethics of the review process. As such, our POs work closely with our Conflicts Official to identify and manage identified COIs. Panelists indicate their COIs among the set of proposals on the panel; each COI is then recorded in the NSF system and the reviewer is not present in the panel room during the discussion of the proposal with which they are conflicted. The COI situation described above is not something we would typically screen for and instead, our POs rely upon the community of reviewers to act professionally and ethically to avoid any bias in the review process. We do solicit at least three reviews for each proposal and our POs listen very carefully to the discussions to control for bias. In our PO training sessions, we will include this particular situation of potential bias as an example for the sake of awareness.*

Recommendation: While examining the jackets for the handling of reviewer COIs, the COV noticed the need to avoid the Program Officer conflict of interest as well. There is, however, no clear guidance stipulating this kind of COI. The COV recommends CMMI consider this issue and provide guidelines for the reviewers and for future COVs. (Section II.3)

CMMI Response 2019: *The situation where a PO has a COI with a proposal on a panel they are managing is quite rare but the process for managing it is well established. The PO is recused from the room during discussion, the same as is done for a reviewer. Another PO manages the review of such a proposal through the entire process including assigning reviewers, managing the panel discussion, preparing the Review Analysis (RA), making the recommendation, and handling any*

follow-up communication with the PI(s). The RA is signed by the substitute PO and a Diary Note should be created in the proposal eJacket describing the PO COI. We will include this description of the process of training materials for future COVs.

Recommendation: The COV recommends that specific terms of the final award decision be included in the award notice (e.g. partial funds awarded for a specific challenge). (Section I.6)

CMMI Response 2019: *CMMI will remind POs to include a summary of any change of terms from the original proposal in the Review Analysis section. Any change of proposed project scope or budget is generally detailed in the Diary Notes or Correspondence sections of eJacket and only done after conversations with the PI(s).*

Balance of award portfolios of CMMI programs

Finding: Overall, at the division level, the COV commends CMMI on the management of the division portfolio to balance limited resources across a diverse set of investigators, a large number of proposals, and emerging areas of research. The efficacy of the clusters and the consolidation of four programs into one in AM is still to be determined.

Recommendations: The COV recommends that CMMI would benefit from a long-term analysis of the impact of the organizational structural changes, particularly in terms of demographics and award size and duration. (Executive Summary)

The COV recommends CMMI consider performing a self-assessment of the effect of its reorganization and consolidations. (Section III.2)

CMMI Response 2019: *CMMI plans to conduct a comprehensive study of trends in proposal submission and awards including factors such as PI and institutional demographics, award size, etc. Unfortunately, some of the factors may be confounded such as changes in Program Officers (POs), program consolidations, and removal of deadlines. Anecdotally, PIs have expressed an appreciation of the AM program consolidation because it makes it much easier to determine program fit for proposal submissions.*

Finding: With regard to individual programs, due to the limited sample of proposals provided, the COV found it difficult to accurately assess award portfolios within programs. Reviewing numbers of proposals, awards, and funding rates is not enough to understand program balance and prioritization.

Recommendations: The COV encourages CMMI to do a full analysis of portfolio data by program, comparing across programs, and benchmarking with programs across NSF. (Executive Summary)

The COV recommends more transparency on variability on budget size, otherwise, it will be hard to comment on portfolio planning. It is recommended that CMMI undertake an internal evaluation to compare plans and execution using all data at their disposal. (Section III.3)

The COV recommends that CMMI investigate measures to continue to reduce proposal load impact as well as the actual proposal load. This could include realigning responsibilities of staff, using clusters to limit multiple proposal submissions by encouraging EAGER submissions followed by larger/longer awards, or other management initiatives. For example, data indicates that the average award during FY15-FY18 was just under $350,000 for just over 3 years duration. Perhaps the impact of moving towards $500,000 for 4 – 5 years for the typical core program award could be investigated. (Section IV)

In line with the recommendation regarding balancing and prioritization within programs already given, the COV suggests that a thorough analysis of program portfolios be conducted. The division could then perform several analyses regarding "right-sizing" and resource management for programs and the division, as benchmarked against NSF as a whole. It may provide an impetus for the resource reallocation to the division. (Executive Summary)

The COV recommends that NSF recognize the need for additional resources for CMMI to meet all its responsibilities while maintaining a high level of productivity with proposal merit review. Additional resources are needed to reduce the workload for POs and review panels. (Other Topics)

CMMI Response 2019: *CMMI does regular analyses of workload balance and uses the results to adjust resource allocation. We plan to use the results of the planned study to consider further reallocation as the result of removing deadlines (effective FY19) from our core programs. Most CMMI POs are also involved in initiatives outside the division (and outside the purview of this COV) such as the Big Ideas, the National Robotics Initiative, and Major Research Instrumentation. CMMI management includes the proposal processing resulting from these activities in our workload analyses. The data are evaluated at the program level and aggregated for comparison to other divisions across NSF.*

Recommendations: To improve the presentation of the portfolio balance, we recommend tracking and presenting information from the CMMI in a larger context. For example, the number of CRISP proposals considered by CMMI was answered in the materials provided to the COV, but it was not clear if this was a proportional share of the proposals submitted to the NSF at large. If there are some special programs that are received in more abundance by CMMI than other NSF program areas, this could help shape the strategic mission of the CMMI in the next 5-10 years. Similarly, information on the age, gender, and ethnic background of CMMI grantees are useful, but it does not provide any comparison to the NSF at large. If the CMMI is receiving a larger or smaller share of proposals from investigators of different backgrounds, this could help the CMMI develop a strategic plan for the future. (Section IV)

CMMI Response 2019: *CMMI will analyze the participation of its typical PI community in other NSF cross-cutting and Big Ideas solicitations and compare its PI demographic data against NSF at-large as suggested by the COV and use the result to inform its divisional strategic plan.*

Finding: The increased responsiveness of the NSF program to emerging research opportunities apparently motivated the EAGER (Early-concept Grants for Exploratory Research) funding mechanism 'to support exploratory work in its early stages on untested – but potentially transformative – research ideas and/or approaches. Despite its high-minded start, the merit review process of the EAGER program appears to be somewhat compromised or suffers inconsistency of

evaluation metrics. The COV examined several cases of EAGER proposals. The evaluation metric ranged from no review, when a proposal is submitted directly to the PO as an EAGER proposal for funding consideration, to a panel discussion, to a formal evaluation by four external reviewers, presumably when a proposal submitted as a regular unsolicited was found by the panel or PO to be more suitable for an EAGER. This may raise the question of fairness.

Recommendation: The COV recommends CMMI pay attention to the transparency and fairness of the EAGER review process. (Section III.2)

CMMI Response 2019: *The NSF Policy on EAGER proposals, as described in the PAPPG, allows for variations on how research ideas are generated and invited for EAGER proposal submission. The policy requires, except under unusual circumstances, that the proposals be reviewed internally to NSF, and this review can take various forms.*

Recommendation: The COV recommends that CMMI consider additional funding mechanisms for early career/unfunded faculty. (Section IV)

CMMI Response 2019: *Discussions are ongoing on this issue within CMMI. CMMI strives to include early-career faculty in panels, during outreach, and through the CAREER Proposal Writing Workshop. As a division, we continue to invest a larger percentage of our budget each year on CAREER awards and use a PI's early career status as a consideration when making award recommendations.*

Recommendation: The COV recommends that CMMI develop a more proactive approach, working with the research community and/or across NSF to develop metrics that can be used to judge the transformative impact of the proposed research. Tracking the status of proposals identified as being transformative and/or innovative submitted by a broad background of investigators from across the division, evaluating the relative success, and considering how to grow a cohort of investigators would enhance this aspect of CMMI portfolios. (Section IV)

CMMI Response 2019: *CMMI is currently discussing what constitutes the metrics of transformative research. Coupled with that, CMMI expects to hire additional engineering/science analysts to assist in identifying and tracking the outcomes of transformative projects in the coming year.*

Responsiveness to previous COV comments and recommendations

Recommendation: The COV recommends CMMI provide the new materials developed as a result of the previous COV – Broader Impacts review process, new review analysis, and PO recommendation templates, declination templates, etc. In addition, the COV also recommends

CMMI provide Workshop funding data since workshops are so important for exploring new directions and portfolio development. (Section III.4)

CMMI Response 2019: *CMMI can provide templates and can summarize workshop funding to future COVs.*

Recommendation: Relative to some of the structural changes that CMMI has implemented, this COV's limited sample and short-term perspective would benefit from a more long-term view of their impact. The COV recommends CMMI benchmark between different programs and with other NSF divisions. The resulting data will be useful for the next COV. (Section III.4)

CMMI Response 2019: *The study described in the "Balance of award portfolios of CMMI programs" section will address this recommendation as well.*